Letters to the Editor.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Heredity and Acquired Characters.

IN his letter headed "Heredity" published in NATURE of November 25 Sir Archdall Reid has not done justice to himself or to your readers. He endeavours to gain attention once more for a jocose misrepresentation of the meaning of the term "acquired characters," and in order to do so neglects to mention the fact that in NATURE, vols. lxxxviii. and lxxxix. (1911 and 1912), the matter was very fully treated in letters from himself and others, including two from me (vol. lxxxix., p. 61 and p. 167). It is the simple fact that in those volumes Sir Archdall Reid had his fling in attempting to mystify your readers with a facetious misrepresentation of the proper use of the term "acquired characters." The fictitious nature of the case presented by him was exposed at that time, and he adds nothing to it to-day. It would be sufficient to refer your readers to that correspondence, the mention of which is avoided by Sir Archdall Reid on the present occasion, were it not difficult for many people to obtain the volumes in which it occurs.

I may, therefore, state here that Sir Archdall Reid's joke or trick consists in ignoring the special and definite significance which has been given (originally, I believe, by Wallace) to the term "acquired characters," namely, that of an English equivalent or code-term for Lamarck's words "les changements acquis." He, on the present occasion, as in 1911, deliberately and professedly treats the statements of accredited writers concerning "*acquired characters*" as though they were using those two words in what he calls their "natural sense," and not (as they themselves declare they are using them) in the special Lamarckian sense as a "code-term." He thus creates confusion and mystification. He declares that *every* character which makes its appearance in the course of development from the egg-cell to the end of life is in the natural sense of those words an "acquired character," and he charges writers who maintain that "acquired characters" are not transmissible with making a statement which is "purely nonsensical." "There is," says Sir Archdall Reid, "absolutely no meaning in the Neo-Darwinian statement that acquired characters are not transmissible. It is like a declaration that five miles weigh five pounds." To that the obvious reply is: "If you, without any warrant, alter the established signification given by the Neo-Darwinian to the chief term in his statement, you can, of course, convert it into nonsense, and your proceeding is merely farcical."

Though many readers of NATURE are undoubtedly acquainted with Lamarck's "Philosophie Zoologique" and the careful definition given by him of what he meant by his words "les changements acquis," it is desirable to cite here what Lamarck said, since Sir Archdall Reid, in order to give an air of sincerity to his little joke, poses as an ignoramus, and possibly others really do not bear in mind Lamarck's statements. Sir Archdall Reid says (November 25): "I daresay I am wrong, but I should be glad to learn just how I am wrong." Further, he writes: "If it be thought that I am mistaken as to all this, can anyone tell us in precise terms what in the world the Lamarckian controversy was *about?*" It is difficult to suppose that Sir Archdall Reid has not read his Lamarck, and still more difficult to believe that he has forgotten the letters published in NATURE in 1911 and 1912, where he was plainly told "just how he is wrong," and also what the Lamarckian controversy was, and is, about. In any case, I will now quote what Lamarck wrote about "les changements acquis" and state what the Lamarckian controversy was, and is, about. Lamarck enunciated in his "Philosophie Zoologique" (Martin's edition, vol. i., p. 235) two laws, the first of which postulates the production of departures in shape and structure of the organs of an animal from the shape and structure normal to the species in normal conditions—when the animal is subjected to what were hitherto unusual conditions; whilst the second asserts that the changes thus acquired ("acquired characters" of English writers) are transmitted in generation to offspring. The limitations given by Lamarck's own words must, of course, be carefully observed. Lamarck writes:

"PREMIÈRE LOI.—Dans tout animal qui n'a point dépassé le terme de ses développements, l'emploi plus fréquent et soutenu d'un organe quelconque fortifie peu à peu cet organe, le développe, l'agrandit et lui donne une puissance proportionnée a la durée de cet emploi; tandis que le défaut constant d'usage de tel organe l'affaiblit insensiblement, le détériore, diminue progressivement ses facultés, et finit par le faire disparaître.

"DEUXIÈME LOI.—Tout ce que la nature a fait acquérir ou perdre aux individus par l'influence des circonstances où leur race se trouve depuis longtemps exposée et, par conséquent, par l'emploi prédominant de tel organe, ou par celle d'un défaut constant d'usage de telle partie; elle le conserve par la génération aux nouveaux individus qui en proviennent, pourvu que les changements acquis soient communs aux deux sexes, ou à ceux qui ont produit ces nouveaux individus."

Those are Lamarck's two laws. The first is universally admitted to be a correct statement of observed fact in numerous cases, though it is not to be accepted as formulating a primary or fundamental property of living matter.

The second law—stating that "les changements acquis" (for which words, in the exact sense in which Lamarck used them, the English term "acquired characters" was many years ago adopted and established as an equivalent) are preserved by generation to the new individuals born from the parents which have acquired those changes in accordance with the first law—has been challenged by many naturalists and accepted by others. Lamarck makes it abundantly clear that the characters transmitted to a new generation—with which he is concerned—are *changes* in form and structure acquired by the parents as a result of *more frequent and sustained use* of some organ or of *constant disuse* of such organ resulting from the influence of circumstances to which their race has been for a long time exposed. It would have rendered misapprehension more difficult had the term "acquired changes" been adopted instead of "acquired characters" as the English equivalent of "changements acquis." The distinctive attribute of the acquired characters so indicated and defined is that they are departures (either increase or decrease) from the usual or normal size, form, or structure of this or that part, arising in an organism "which has not yet passed the limit of its [individual] development" when that organism is submitted to novel conditions. They are *novelties* which arise under *novel* conditions, departures from the normal which occur when the environment ceases to be—*in certain important par-*

© 1920 Nature Publishing Group

ticulars—that which is associated with the normal form of the species.

The "Lamarckian controversy" about which Sir Archdall Reid affects to be ignorant was, and is, as to whether the changes of structures set up in the manner indicated in Lamarck's first law are ever transmitted by generation to progeny. It has been demonstrated that such changes do occur, but no satisfactory evidence of their transmission by generation to progeny has been produced. It is admitted that, so far as we know, such a transmission is *possible,* and, in the period at which Lamarck wrote, the assumption that such transmission occurs was a reasonable one. But hitherto all attempts to give convincing demonstration of its occurrence have failed, though such attempts have been, and still are, made by able biologists.

Before concluding this letter, may I direct the attention of readers of NATURE to the correspondence on this subject which was started by Sir Edward Fry in 1894 (vol. li., p. 54), to which I contributed a long statement? Sir Edward, owing to his lack of acquaintance with Lamarck's writings, was genuinely misled by the term "acquired characters," then less familiar than it is to-day. E. RAY LANKESTER.

December 8.

IN NATURE of November 25 there appears a long letter from Sir Archdall Reid on the subject of heredity. In this letter he seeks to show that the whole controversy about the inheritability of acquired characters—perhaps *the* controversy of most vital importance in biology—is a mere "pother" about "words full of sound and fury, signifying nothing." "All the characters of the individual," he assures us, "are innate, acquired, and inheritable in exactly the same sense and degree."

Sir Archdall Reid must have a singularly poor opinion of the intelligence of his co-workers in the field of biology if he thinks that they have wasted, and are still wasting, their time in a meaningless controversy. The list of such "wasters," moreover, must include the honoured name of Darwin himself, who had a very clear idea of what was implied in the term "inheritance of acquired characters," only he termed it the "inheritance of the effects of use and disuse."

The fact is that the whole of Sir Archdall Reid's letter rests on a mere play with words. I recollect reading of a lawyer who, in defending a client on a charge of slander, maintained that "villain" was a perfectly harmless epithet, since logically and etymologically it only signified a servant employed on a farm.

Sir Archdall Reid begins by stating that all characters are acquired in response to external conditions, since there are no characters, but only potentialities, in the formless germ, and these potentialities will not be realised unless conditions are favourable. Did Sir Archdall Reid imagine that this was doubted by any biologist? Is it not, on the contrary, so elementary and self-evident that every biologist, in discussing genetic questions and assuming an irreducible minimum of intelligence in his hearers, takes it for granted?

If, however, Sir Archdall Reid thinks that such an assumption is unjustifiable, let me try to make the issue a little clearer.

The egg of any animal will only develop its innate possibilities as manifested in the features of the adult animal if the surroundings are favourable, but the development results in a definite type. If the surroundings are unfavourable the type may not come to fruition, but there will be an obvious attempt to attain it; the egg of the shrimp, for instance, never shows any tendency to develop into the same form as the egg of a fish. There is, of course, for every egg a particular combination of circumstances which is especially favourable and may be termed the normal environment, and the normal life of the animal and the function of its organs consist in answering the demands made upon it by this environment.

If, now, the environment be altered to such a moderate extent that the animal is still able to respond to it, then the use of certain of the animal's organs and their growth will be altered. On that point all are agreed; the difference between opposing schools of biologists begins when the question is raised as to what will be the characters of the offspring of the altered individual.

The Neo-Darwinian or Weismannian school maintains that the germs produced by the altered animal will be precisely like the germ which gave rise to that animal. If they develop in the normal environment of the species they will give rise to individuals conforming to the normal specific type; if they develop in the same circumstances as their immediate parent they will show similar divergences from the specific type.

The Lamarckian school, on the other hand, contends that the germs of the altered animal *become themselves slightly altered,* so that if they are allowed to develop in the normal specific environment they may still in their earlier stages of growth show a trace of the altered structure of their parent; and, on the other hand, if they are allowed to develop in the same circumstances as their parent they will manifest the altered structure acquired by the parent *more rapidly and in stronger degree than did the parent.*

I have already had occasion to direct the attention of readers of NATURE to the fact that certain experimenters on the Continent claim to have established the truth of these two essential postulates of Lamarckism. This claim may be ill-founded or well-founded—that is a matter for argument—but no reasonable Neo-Darwinian would fail to admit that if the claim proves to be well-founded the Lamarckian position will be established.

Sir Archdall Reid states that, "apart from variation, like exactly begets like when parent and child develop under like conditions." Leaving aside for the moment the quibble about the word "variation," the Lamarckian contention is that like does not "exactly beget like," but that the influence of conditions on the character of the individuals composing a species *is cumulative from generation to generation.* There is a rapidly accumulating body of evidence in favour of this view; for a piece of evidence to which my attention has recently been directed I am indebted to my friend and colleague, Prof. Dendy. It is as follows: The peach in Europe is a deciduous tree. Transplanted to Réunion it has become an evergreen in the lowlands of that island, but has remained deciduous in the highlands. If a seed be taken from the evergreen tree and grown in the highlands it will still in the first generation give rise to an evergreen tree, although its ancestors were undoubtedly deciduous.

Finally, I should like to say that the sense in which I understand the word "variation," and the sense in which I think it is understood by the majority of my co-workers, is a divergence from the normal appearing among the offspring of a normal individual *when the normal environment remains unchanged,* and in that sense it should be used by Sir Archdall Reid. E. W. MACBRIDE.

Imperial College of Science, South Kensington,
London, S.W.7. December 8.

© 1920 Nature Publishing Group